Esri Response to VT Open GeoData Portal Project RFI

Prepared for:

Steve Sharp
Director of Enterprise GIS Services
VT Center for Geographic Information
58 S. Main St, Suite 2
Waterbury, VT 05676
steves@vcgi.org
802-882-3006

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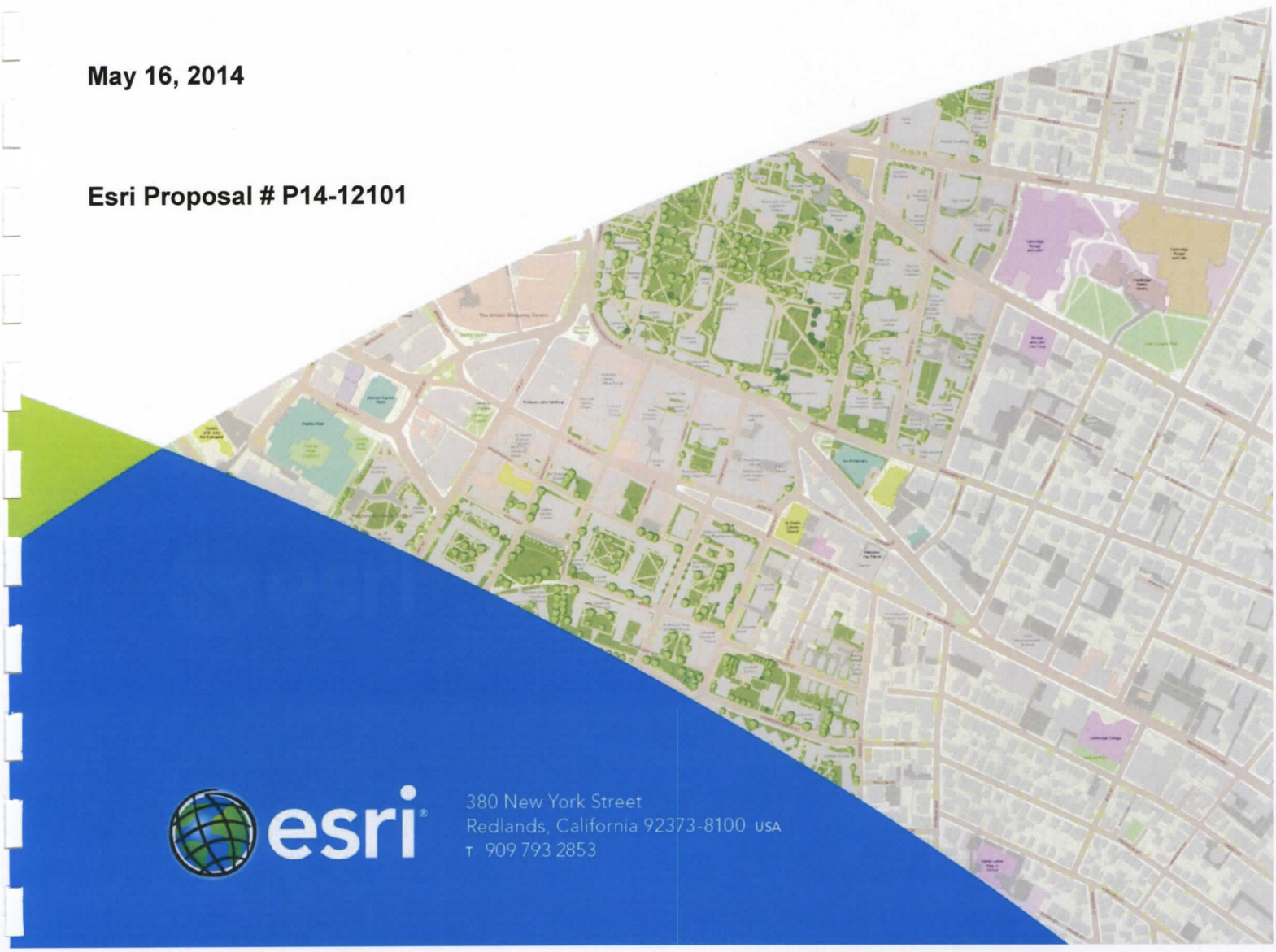

380 New York Street
Redlands, California 92373-8100 USA
T 909 793 2853

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1.0 Introduction

Esri is pleased to present this response to the Vermont Center for Geographic Information (VCGI) request for information regarding the VT Open GeoData Portal Project. Our understanding is that the current GeoData Portal is over a decade old and lacks the capabilities and functionality that end users need and expect, requiring modernization. Our Commercial Off-The-Shelf (COTS) products have evolved to better meet the needs of the geospatial community and the solution outlined below represents a modern, robust, and cost-effective means to meet the strategic goals and objectives of VCGI, as outlined in the RFI. It also meets the broad vision of connecting publishers and consumers in a user-driven portal that facilitates finding, exploring, contributing, and consuming geospatial information.

The approach leverages the previous investments VCGI has made in Esri technology, which have been significant, but also builds on the accumulated intellectual capital and trust VCGI has earned among the stakeholder community over the years, as a strategic coordinator, partner, and source for authoritative geospatial information. In addition to COTS technology, we also bring ample implementation, consulting, and training experience to the table to help achieve project success for all of our customers, VCGI included. We hope you will find the proposed approach meets your needs to serve the community in the most direct manner possible.

Esri envisions a VCGI GeoData Portal based on the concept of Web GIS Platform implemented by ArcGIS COTS products. With the proposed platform you can use the VCGI GeoData Portal to:

1. Create, manage and share web maps, web services and related content.
2. Leverage ready to use Apps for viewing, analysis, open data, data collection, storytelling, mapping, etc.
3. Manage user identities, groups, content, access and system administration.
4. Share VCGI geospatial resources as "services"
5. Manage VCGI content

The platform is also easily extensible through developers APIs and SDKs and the standard service interfaces the platform exposes.

2.0 Summary Response Form

Q	Response
Company name Parent company	Environmental Systems Research Institute, Inc. (Esri) N/A
Company address	380 New York Street Redlands, California 92373
Name of person responsible for the information contained	Roberto Lucchi
Telephone number Fax number Email address Web page	909.793.2853 Ext. 5840 909.793.5953 rlucchi@esri.com www.esri.com
Company location: Corporate office Local offices	Esri 380 New York Street Redlands, California 92373 Esri Boston Regional Office 35 Village Road Suite 501 Middleton, MA 01949 978.777.4543
Please provide your recommendations on the system solution design for a VT Open GeoData Portal that would support the requirements articulated in this RFI. • Are there any functional requirements that you believe could be especially challenging or costly to implement?	Please see Attachment A - VT Open GeoData Portal Solution Design
Are you proposing to use a Commercial-Off-The-Shelf (COTS), Open Source, custom, and/or hybrid solution?	The solution described is based on Esri COTS products. Esri's Geoportal Server is released under the open source Apache 2.0 license.

Q	Response
Training: • Would you offer formal user training? • What type of courses do you run and what is their duration? • What level of training would you recommend?	Esri offers formal instructor-led training at Esri classroom facilities, customer locations or online. Instructor-led online training is a popular option covering the spectrum of desktop, server, and web technologies. We recommend purchasing a Training Pass which provides an established number of student training days. For general purposes over the three (3) year period, we recommend a 20-day training pass (assuming 2 students taking 3-4 classes). See classes and more about the program at http://www.esri.com/training/main/training-pass.

Q	Response
Please provide details of how the product is supported. • What levels of support is available, definition of each level and what are the hours of operation and response times? • Does support include product updates, as well as bug fixes at no extra charge?	Esri's Product Life Cycle Support Policy is designed to help communicate to Esri users the technical support resources available during a product's life span and to provide advanced notification of planned changes to available support options. Read more about this in our Product Life Cycle Support Policy at http://support.Esri.com/en/content/productlifecycles. Customers with Standard Support who are current on maintenance receive the latest software releases, service packs and patches. Standard Support customers also have access to unlimited phone support, as well as vast online resources, such as product documentation, the Esri Knowledge Base, Web-based help, user forums and the Customer Care Portal. The Esri Customer Care Portal (http://customers.Esri.com) gathers the organizations and personal information from the various Esri systems and online services into one location. For ArcGIS for Desktop and ArcGIS for Server licenses that are eligible for upgrades, the software can either be downloaded through the Esri Customer Care Portal or, depending on the product, receive physical backup media for installation. ArcGIS Online is a cloud-based solution which is periodic updated. These updates are deployed to the system and will automatically take effect. Please make sure to clear your cache after each update to make sure that the changes take proper effect. Esri publishes the list of enhancements via ArcGIS Resources: http://resources.ArcGIS.com/en/help/ArcGISonline/index.html#//010q00000006000000. New releases of Esri Geoportal Server are typically provided twice a year. Because Geoportal Server is an open source product, there is no license fee or cost to upgrade and you can do so at any time.

Q	Response

Please summarize the total costs of your proposed solution.
• Total estimated cost of proposed solution.
  ○ Year 1 – Build and Deploy
  ▪ Combined estimate for all requirements under Section 6.1
  ▪ Combined estimate for all requirements under Section 7.2 – APPENDIX II
  ▪ Other costs itemized for Year 1
  ○ Year 2 – Support and Maintenance (itemized)
  ○ Year 3 – Support and Maintenance (itemized)
• What are the estimated licensing costs (if any) for individual parts of the solution?
• What are your consultancy rates to help with implementation and/or customization?
• What do you charge for training?
• What are the estimated maintenance and support costs on an annual basis? Does it include software updates/upgrades?
	Please see Attachment B - Summary of Estimated Solution Costs and Attachment C – Time and Material Rate Schedule below.

Attachment A VT Open GeoData Portal Solution Design

Understanding

Esri understands VGCI aims to implement a VCGI GeoData Portal which connects data providers and users interested in shared geospatial assets and applications. Users may have different backgrounds and expectations, and may want to connect to the shared resources by using a browser, a smartphone or a desktop application. Figure 1 illustrates, via different perspectives, the goals VCGI GeoData Portal seeks: user types, functionalities and devices, integration and content. The VCGI GeoData Portal enables searching and using geospatial resources provided by the portal, by other programs such as Data.gov, or other external catalogs based on standards. The content VCGI shares includes GIS data, aerial photos, and documents. The VCGI GeoData Portal would have to be accessible from web browsers, from smartphones and specialized GIS applications. The VCGI GeoData Portal targets different user types, some users may be interested in a subset of the functionalities the portal provides. Given the potential difference in technical knowledge the way to share and deliver content may have to take into account the expertise and the expectation users have.

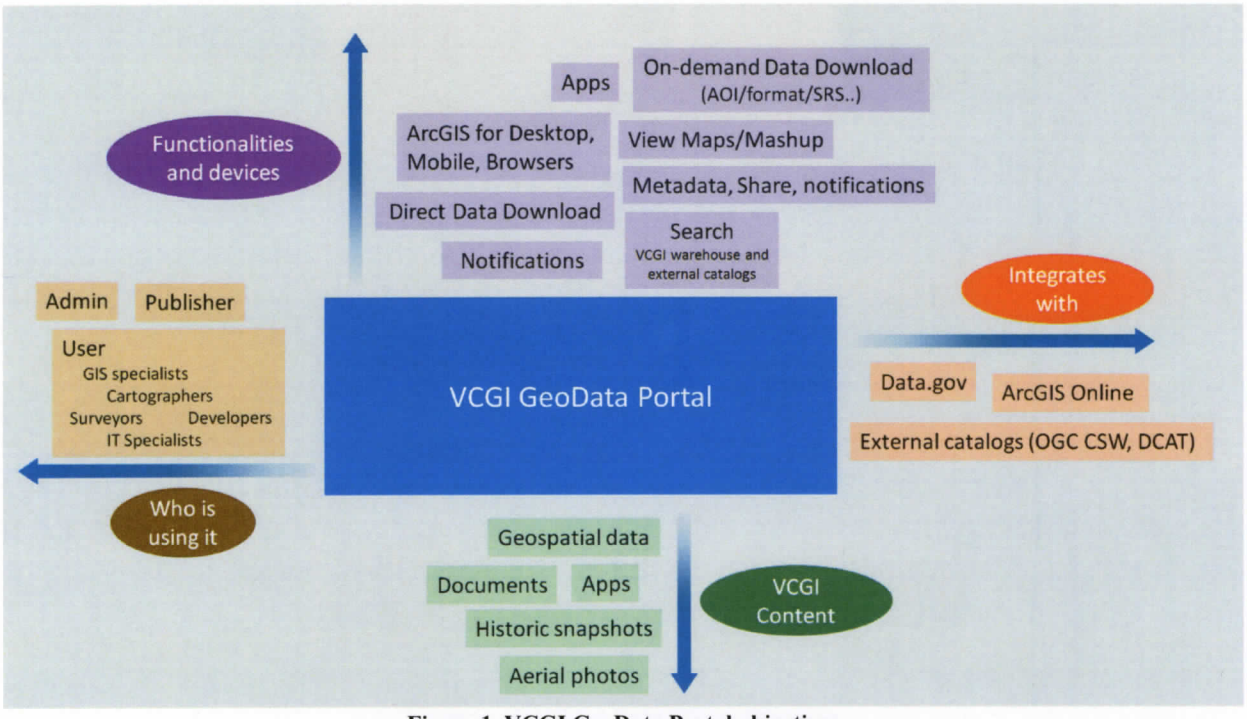

Figure 1. VCGI GeoData Portal objectives

Esri also understands that the use of COTS technology and mature support for tech support, software updates and training are essential requirements for the VCGI GeoData Portal.

The ArcGIS Platform

Esri has recently introduced the ArcGIS platform whose architecture supports and is fully integrated with currently deployed ArcGIS system components such as ArcGIS Desktops and Servers. These individual components, in addition to being powerful standalone technologies, belong to a larger ecosystem of

technology that delivers many benefits to the GIS users as well as the broader enterprise community. The additions of ArcGIS Online and Portal for ArcGIS along with the new world of easy to use apps that run anywhere make Esri products radically different. This architecture is referred to as a "Web GIS Platform". This new generation of technology is designed to transform how people think of, see, and use their data making it practical to apply geographic thinking everywhere across organizations. This platform also has the effect of enabling cross organizational sharing and collaborations realizing the vision of GIS as infrastructure (i.e. NSDI).

ArcGIS implemented as Web GIS is a new pattern that is transforming GIS into a platform. Figure 2 depicts the main platform elements. The core of this platform is GIS expressed as "services." Apps make this platform easier to use, accessible from any device with an agile architecture for sharing, mapping, analysis and visualization. APIs and SDKs provide a means for developers to further extend and create new applications for multiple operating systems and devices. In essence, Web GIS supports multiple communities: the GIS professional, users interested in mapping and geo-enabled data, and developers.

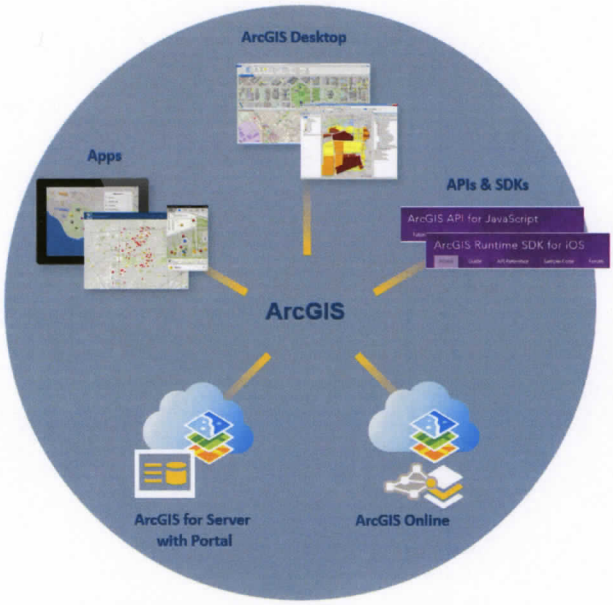

Figure 2 ArcGIS Implemented as Web GIS

The Web GIS pattern is technically enabled using ArcGIS Online (open web) or ArcGIS Server with Portal (on premises). Both of these solutions provide users with the following capabilities:

1. Create, manage and share web maps, web services and related content.
2. Apps for viewing, analysis, data collection, situational awareness, storytelling, mapping, etc.
3. Ability to manage user identities, groups, content, access and system administration.
4. Open data sharing as "services".
5. Content management.

Figure 3 ArcGIS Online Applications

Figure 3 summarizes the ArcGIS Online applications that are part of the platform. For details please visit http://www.arcgis.com/features/apps/index.html.

Proposed Solution

Esri envisions a VCGI GeoData Portal based on the concept of Web GIS Platform implemented by ArcGIS. Esri offers COTS products for meeting the VCGI GeoData Portal requirements. The selected COTS components are described in the following subsections.

ArcGIS for Server

ArcGIS for Server gives you the ability to create, manage, and distribute GIS services over the web to support desktop, mobile, and web mapping applications.

With ArcGIS for Server, you can:

- Connect more people with the information they need to make better decisions.
- Publish fast, intuitive web mapping applications and services tailored to your audience.
- Simplify access to your services, data, and imagery.

ArcGIS for Server supports desktop, web-based, and mobile workflows. It helps you protect and manage your mapping information, and it provides a scalable platform that satisfies everything from the simplest to the most complex web mapping requirements.

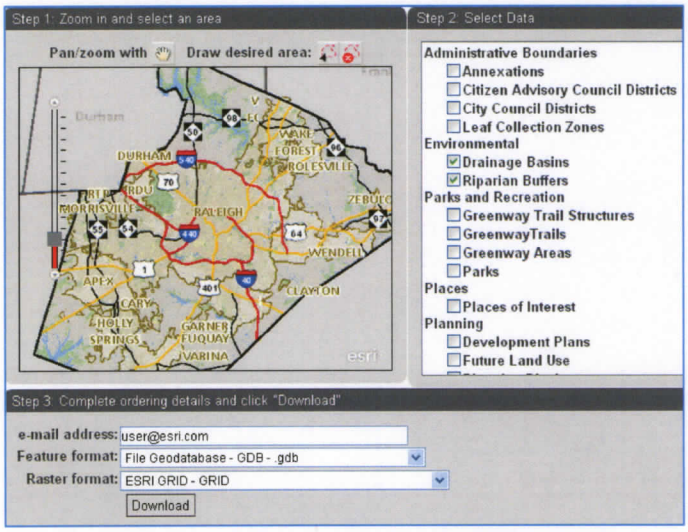

Figure 4 : City of Raleigh leverages ArcGIS for Server geoprocessing services to provide Clip and Ship functionality.

Further, ArcGIS for Server provides powerful geoprocessing capabilities that can be served over the web. An example is the 'Clip and Ship' sample that supports users downloading data for a specific extent in the format of their choice.

ArcGIS for Server services can be cataloged and discovered through ArcGIS Online, Portal for ArcGIS and/or Esri Geoportal Server.

ArcGIS Online

ArcGIS Online is a cloud-based geospatial content management system for storing and managing maps, data, and other geospatial services. It complements existing enterprise GIS infrastructures while also providing a rich set of tools, hosting capabilities, and applications to store, manage, and host mapping services. ArcGIS Online also allows users to easily publish geographic content for use within and beyond the organization by both specialists and non-specialists alike. It also allows users to off-load selected processing activities from existing infrastructure and move them to the cloud. For more information on ArcGIS Online visit http://www.esri.com/software/arcgis/arcgisonline, for detailed information on available apps please visit http://www.esri.com/software/arcgis/arcgisonline/features/apps.

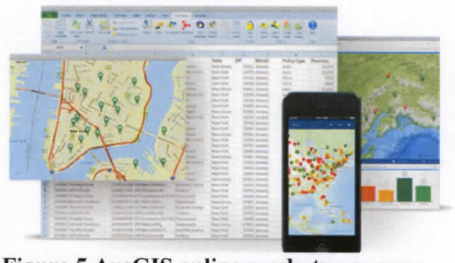

Figure 5 ArcGIS online ready to use apps

ArcGIS Open Data

ArcGIS Open Data is a new ArcGIS Online App (http://www.esri.com/software/arcgis/arcgisonline/features/apps) which provides open data access to the public. You can quickly set up a branded website and use your existing ArcGIS platform to manage and maintain your open data. Select the authoritative data you want to share and allow anyone to search and download your data by topic or location, or display it on an interactive map. Figure 6 shows an ArcGIS Open Data website, data you find in an Open Data site is freely available for you to explore, verify, and access:

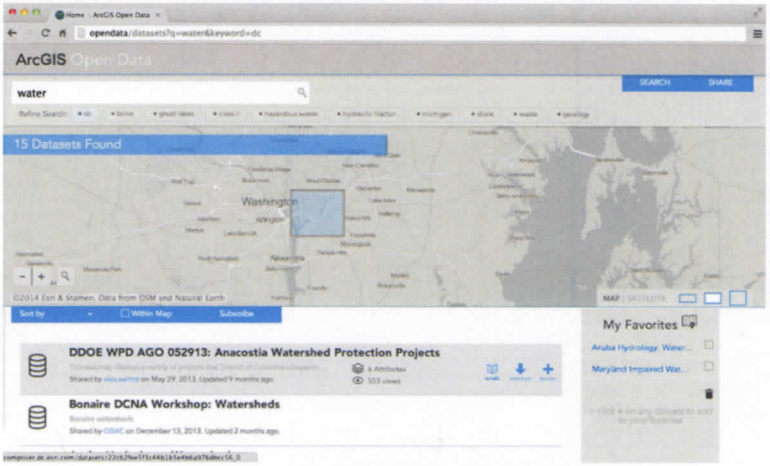

Figure 6 ArcGIS Open Data website

- **Explore**—Search and find related open datasets from authoritative data providers.
- **Verify**—Review detailed information about the data and the provider.
- **Access**—Download data in common formats (CSV, KML, and shapefile). Developers can also access data through JSON.

For more information visit http://blogs.esri.com/esri/arcgis/2014/04/24/arcgis-open-data-beta/.

Geoportal Server

Esri Geoportal Server (http://github.com/Esri/geoportal-server) is a free, open source product that enables discovery and use of geospatial resources. It helps organizations manage and publish metadata for their geospatial resources to support users in discovering and connecting to those resources. The Geoportal Server supports standards-based clearinghouse and metadata discovery applications.

Geoportal Server can also serve as a software service broker. A service broker connects different data sources and services to one another. It provides access to a variety of resources and exposes these resources not only through human-readable interfaces but also machine readable ones. Particularly, the ability to register multiple types of resources for harvest/discovery, the ability to direct a search to a remote endpoint, the ability to discover resources hosted at or through the Geoportal through standards-based protocols, and the ability to provide data for download in a variety of formats represent functionality essential in a service broker.

The Geoportal Server provides a user-interface and also OGC Catalog Service for the Web (CS-W), REST, and OpenSearch service endpoints for communicating with its catalog. Geoportal Server can be paired with Portal for ArcGIS to provide these service capabilities to Portal implementations, and also support formal geographic metadata standards in the Portal for ArcGIS environment. In its latest release support for DCAT has been added (visit https://github.com/Esri/geoportal-server/wiki/Geoportal-Server-1.2.5---What%27s-New for more details).

Architecture

The solution architecture is illustrated in Figure 7. Esri envisions a solution that brings together the interoperable brokering capabilities of the Esri Geoportal Server with the built-in map viewing and sharing capabilities of ArcGIS Online, integrated with the ability to serve data and geoprocessing tasks through ArcGIS for Server. This solution connects users to data content and tools they can access on any web-enabled device.

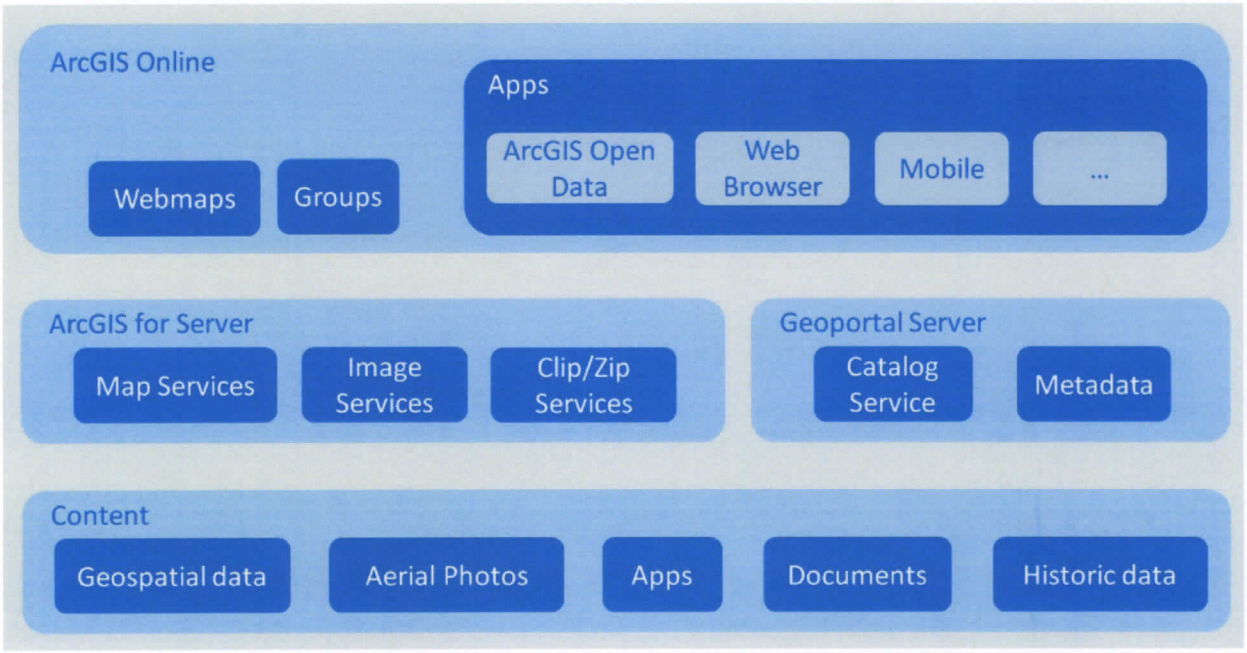

Figure 7 VCGI GeoData Portal solution components

Benefits of proposed solution

Esri anticipates that the proposed solution will provide the following benefits:

- Based on Esri COTS products,
- Operation and maintenance support based on Esri COTS product maintenance,
- Re-use of VCGI knowledge and licenses of Esri products as well as of the existing IT development and production environments:
    - ArcGIS for Desktop
    - ArcGIS for Server: http://maps.vcgi.org/arcgis/rest/services
    - ArcGIS Online subscription: http://vcgi.maps.arcgis.com/home/
    - Database Servers (MS SQL Server 2008 R2MS SQL Server). Esri anticipates the same database servers could also be used for Esri's Geoportal Server.
- By providing appropriate training and support during the VCGI GeoData Portal install and configuration phase, VCGI Staff can develop the capacity to prepare and publish content and services as well as sustain the operation aspects.

It is also noteworthy that the content shared via ArcGIS Online can be easily exposed in different environments such as MS Office, SharePoint or Drupal. Esri has released an open source Drupal module which enables you to display content from ArcGIS.com, ArcGIS Online Subscriptions, or Portal for ArcGIS. By leveraging such a module VCGI could expose maps, apps and galleries made available through ArcGIS Online also in the in the VCGI Drupal-based website (http://vcgi.vermont.gov/).

VCGI GeoData Portal

This section exemplifies how the VCGI GeoData Portal objectives can be achieved with the proposed solution.

Users

ArcGIS Online provides a built in identity store and a custom user role configuration tool. While the authentication can rely on the built in identity store, it is also possible to configure Enterprise Logins which gives members of your organization the option to log in to ArcGIS Online using the same logins that they use to access your enterprise information systems instead of with an ArcGIS Online login (the Sign In page will display both options). Enterprise Logins is achieved through SAML Web Single Sign-On. Details on how to create users, set permissions at user role level and manage named users is available at http://doc.arcgis.com/en/arcgis-online/administer/invite-users.htm.

Anyone can search and access publicly shared resources. Other organizations or users willing to contribute content can leverage the same ArcGIS Online subscription model to participate and share other geospatial assets in the VGCI GeoData Portal. A developer-specific subscription model is also available, for details please visit see https://developers.arcgis.com/en/features/.

Content registration (VCGI warehouse)

ArcGIS Online provides content management system capabilities to register and host multiple types of resources such as geospatial data, services, apps and documents. VCGI data, ArcGIS Server services, apps, and documents can be registered and shared by using the VCGI ArcGIS Online subscription. For a

detailed list of supported content types please visit http://doc.arcgis.com/en/arcgis-online/share-maps/supported-items.htm.

Sharing

You can share your content with everyone by using the VCGI ArcGIS Online subscription. You can also share the same content on social networks such as Facebook and Twitter, or embed the same maps within other websites by simply copying HTML code snippets.

In addition to sharing individual VCGI resources, you can create and share webmaps and respective application templates which provide a way to deliver maps in which in which important information is highlighted using pop-up windows, charts, and infographics. Story maps apps (http://storymaps.arcgis.com/en/) are examples of apps which helps conveying a very specific story from a webmap. Webmap capabilities are described at http://doc.arcgis.com/en/arcgis-online/create-maps/make-your-first-map.htm. Delivering the created map products to everyone via application templates is described at http://doc.arcgis.com/en/arcgis-online/create-maps/make-your-first-app.htm.

ArcGIS Online groups and galleries provide a means to organize your content. For example, at http://geoss.maps.arcgis.com/home/groups.html, groups have been used to categorize resources based on societal benefit areas. This approach complements and enriches the search experience; users can use groups and galleries to browse content by category. Some VCGI GeoData Portal categories could define downloadable data, historic snapshots, aerial photos, documents, or a specific thematic area and groups would provide a direct and intuitive way to browse specific set of resources. You can also invite other external contributors to join groups to enrich a specific content category.

Finally, general use web search engines can leverage the ArcGIS Server sitemap document (e.g. http://sampleserver6.arcgisonline.com/arcgis/rest/services/?f=sitemap) to index ArcGIS Server services.

Apps

ArcGIS Online Application templates help you deliver your map products (webmaps) everywhere. These application templates, as well as map story apps, provide a simple and intuitive view of maps and are particularly suitable for non-GIS users (e.g. decision makers, the entire organization, citizens) who need only a few focused and easy-to-use tools. In addition, other ready-to-use apps can provide a view into the VCGI GeoData Portal such as an ArcGIS App designed for smartphones and tablets. VCGI GeoData Portal users can connect to the shared resources via web browsers, smartphones and desktops. For more information please visit http://www.esri.com/software/apps/.

The ArcGIS platform is also easily extensible through developers' APIs and SDKs and the standard service interfaces the platform exposes. VCGI could use such frameworks to extend and create VCGI-specific functionalities or views of VCGI geospatial assets, as could other developers and organizations.

ArcGIS Server provides a means to publish OGC standard interfaces such as WMS, WMTS, WFS, WCS and KML which enable interoperability with different GIS applications.

Search

Users can search ArcGIS Online content made available in your subscription or across ArcGIS Online public content. Keywords, content item tags, and groups are examples of search criteria which can then

be refined by using specific content categories such as maps, tools, and apps. Search results can be sorted by relevance, title, owner, rating, views and date. For more details on search please visit http://doc.arcgis.com/en/arcgis-online/reference/search.htm.

Content discoverability is a key capability ArcGIS Open Data focuses on. Users need simple search and recommendations for finding and following relevant data. Through ArcGIS Open Data, VCGI can configure a website with an organization-specific look and feel and specify Open Data groups to share specific items. The general public can use Open Data sites to search by topic or location, download data in multiple formats, and view data on an interactive map and in a table. As a variety of user types is foreseen for the VCGI GeoData Portal, ArcGIS Open Data will help with outreach to non-technical users interested in discovering, exploring and accessing public items.

View Maps

Users can discover and view public map layers using ArcGIS Online Map Viewer or application templates. With the Map viewer you can combine layers and services to create map products that can be further shared with other users. Users can add layers exposed by Map Services, Image Services, GeoRSS, OGC WMS, WMTS and KML. For more details on Map viewer please visit http://doc.arcgis.com/en/arcgis-online/use-maps/view-maps.htm.

Feedback

There are different tools in ArcGIS to collect and monitor user feedback. ArcGIS Online content items have user comment and rating sections. This is used to provide item statistics. Users can also sort search results based on feedback.

Statistics on service usage are available to ArcGIS Online (for hosted services) and ArcGIS Server administrators. For example, access statistics could be used to identify the most popular map service layers. Most popular map layers could be published and hosted in ArcGIS Online. This deployment pattern would elastically scale up based upon the number of users accessing the service without requiring new hardware in the on-premises ArcGIS Server environment.

Users may also be interested in providing very specific feedback based on location such as indicating inaccuracy or errors in the map layer. An example is available in the ArcGIS Community Basemaps program described at http://www.esri.com/software/arcgis/community-maps-program/contribute-content. VCGI can implement the same pattern: editable feature services and webmaps are used to collect feedback and inform the users about updates, see for example http://www.arcgis.com/home/item.html?id=6365ecd9bd6046d4986159d557e67971.

Download

ArcGIS Open Data has a multi-format data download function, users can also subscribe in order to be notified when a change is made to the item. Commonly downloaded datasets formats and projections could be pre-processed once and made available for direct download in ArcGIS Online. For example, a group could be created to categorize such types of downloadable items.

For more specialized GIS users, ArcGIS online provides analytical tools which can be used to extract data in different formats based on user-defined area of interest. The desired content is delivered in the

respective ArcGIS Online user content. For details please visit http://doc.arcgis.com/en/arcgis-online/use-maps/extract-data.htm.

Geoportal Server includes support for ArcGIS for Server geoprocessing services to provide Clip and Ship functionality to end-users. When downloading data, a user draws the area they wish to download, selects layers for download, selects an output format for the data, and supplies their email address. The Geoportal Server data download page will then use the input information as inputs to the data download geoprocessing service. When the request has been completed, an email message will be sent to the user with an attached ZIP file of their data.

Metadata

Geoportal Server support metadata standards such as FCDC, Dublin core, and ISO 19115/19119 via a web-based metadata editor (for your ArcGIS Online content items).

Integration with other portals

Users can discover resources from other catalogs that are based on standards such as OGC CS-W or DCAT by leveraging Geoportal Server federated search functionalities. The federated search also processes the external catalog search results and derives the links to the resources such as OGC WMS and WMTS, KML and ArcGIS Server services. In this way, users can directly click and view the metadata details and view the respective map layers without having to navigate to external websites.

In order to contribute to other programs such as data.gov the Geoportal Server can be also used to publish an OGC CS-W interface exposing the VCGI GeoData Portal public content so that other portals can access it. The same catalog can be exposed using the DCAT standard.

Harvesting

In addition to on-the-fly federated search, Geoportal Server supports harvesting of metadata (e.g. FGDC, ISO 19115/19119, DCAT) exposed by web accessible folders, OGC CSW catalogs. The synchronization schedule is configurable.

Attachment B Summary of Estimated Solution Costs

The total price for implementation of the solution described above (Year 1 Build and Deploy) is estimated to be $60,000, based on a project schedule that concludes prior to January 2015. These estimates are based on Esri's current understanding of the work to be performed and work on projects of a similar nature. This is not a formal proposal, and the descriptions and rough pricing estimates will not be binding. The estimates below are based on the assumption that COTS Software can be used and configured by VCGI to achieve the VCGI GeoData Portal business objectives as described in the RFI. With the recommended training, Esri anticipates VCGI would be capable of both preparation and publication of content as well as managing the regular solution maintenance operations with VCGI staff. Esri recommends a minimum of one week of onsite technical support followed by two weeks of remote support during the first year to support VCGI in initial software configuration.

Esri has not included estimated costs for satisfying the Optional Requirements (RFI Appendix II) but welcomes the opportunity to further discuss these requirements to gain a better understanding of VCGI's needs.

ROM Estimates for Year 1 Build and Deploy

Item	Training	Professional Services	Software License	Total
System to Include Functional Requirements (RFI Section 6.1)	$10,000*	$40,000	$10,000**	$60,000
			ROM Estimate Total for Year 1	**$60,000**

ROM Estimates for Year 2 and 3 Support and Maintenance

Item	Training	Professional Services	Software License	Total
Year 2 Support and Maintenance			$10,000**	$10,000
Year 3 Support and Maintenance			$10,000**	$10,000

* Includes one 20-day training pass as described above in section 2

** Includes one Level 2 ArcGIS online account. Solution will use State of Vermont's existing desktop and server licensing. There is no cost for GeoPortal extension or the Open Data app.

The actual price to perform this work will be provided to VCGI as a proposal upon its express interest to contract with or upon submittal of a formal RFP. Consultancy rates are included below in Attachment C – Time and Material Rate Schedule. Please feel free to call me at 909-793-2853, extension 5840, or via email at rlucchi@esri.com if you have questions about this ROM.

Contact:

Roberto Lucchi, Consultant/Project Manager

Esri Professional Services

rlucchi@esri.com

Attachment C Time and Material Rate Schedule

Effective January 1, 2014

Hourly time and materials labor rates have been provided for each labor category for calendar year 2014. The hourly labor rates for services that are performed after 2014 may be escalated in an amount not to exceed five percent (5%) each year. Other direct costs, such as travel, reproduction, subcontractor, telecommunication/freight, or materials, will be charged a material handling fee and invoiced.

Esri reserves the right to provide fixed price quotations for professional services requests that require deliverables other than hours. Work performed under fixed price orders will require additional terms and conditions and will be invoiced monthly based on percentage completed.

GIS Technical Specialist/Engineer (S1) Hourly Rate: $197

Staff members in this labor category work collaboratively with software designers to perform software coding and the writing of software documentation according to design specifications developed by senior technical staff described below. As a group, these staff members are experienced in the coding of software and the creation of digital databases, as well as in software development associated with Esri's commercial off-the-shelf (COTS) software products; web, desktop, or server software development languages; geospatial data formats; and other technologies. These individuals also develop effective database designs, implement data conversion processes and procedures, and perform software and database quality control.

GIS System/Software Developer (S2) Hourly Rate: $254

Staff members in this labor category support the design of technical project specifications for the implementation of application software projects and database development projects. They support the day-to-day technical activities of the project team and ensure that standard system methodologies are employed. They also perform detailed software design and detailed database conversion design and are directly involved in the coding and implementation of complex and strategic portions of application software and database conversion projects. As a group, these staff members are proficient in Esri COTS software products; web, desktop, and server software development languages; geospatial data formats; and other technologies. These staff members design and develop QA/QC programs and support design and code reviews, database reviews, and other QA/QC activities throughout the project life cycle.

Senior GIS System/Software Architect (S3) Hourly Rate: $312

Staff members in this labor category provide the overall technical vision and system architecture for large, complex systems. They support the application of sound software engineering principles and life cycle methodologies to programs/projects. These individuals are actively involved in systems architecture design, application software design, database process design,

and the directing of coding development including the supervision of design and code reviews. These staff members may serve as principal investigators in focused studies or research and development projects. Individuals in this labor category have broad technical knowledge of geographic information system (GIS) applications and related information technologies and may also provide specific expertise in areas such as web-based software applications, service-oriented architectures, data warehousing, spatial analysis, and modeling. As a group, these staff members are proficient in Esri COTS software products; software and database design methodologies; web, desktop, and server software development languages; geospatial data formats; and other technologies.

GIS Consultant/Project Manager (M1) Hourly Rate: $239

Staff members in this labor category provide day-to-day consulting and management for contracted projects within Esri. These individuals work under the guidance of senior Esri managers described herein and support the design and implementation of project work plans. These staff members may provide consulting services and design and management support to software application development projects and database conversion projects. They may also conduct detailed requirements interviews, document application requirements, develop logical and physical database designs using standard engineering diagramming methodologies, design software and database QA/QC programs, and provide management oversight of daily technical activities. These staff members work with senior consulting and technical staff to design comprehensive work plans that employ standard system methodologies that define project deliverables, milestones, and realistic schedules. These individuals work with Esri administrative staff to ensure that progress and financial reporting is provided according to contract requirements.

Senior GIS Consultant/Project Manager (M2) Hourly Rate: $301

Staff members in this labor category work as project managers or project advisers, providing strategic consulting and project management activities for GIS and information technology (IT) projects. These staff members have market/application domain expertise using extensive experience in GIS and related geospatial technologies to support the successful completion of a project. Consulting activities may include strategic planning, GIS workshops and seminars development, requirements definition, application and database design, and system integration. Management activities may include defining project requirements and objectives, establishing budgets and schedules, allocating staff and other resources, and managing and overseeing subcontractor activities. These individuals may also design comprehensive work plans that employ standard system methodologies that define project deliverables and milestones and realistic schedules.

Principal GIS Consultant/Program Manager (M3) Hourly Rate: $397

Staff members in this labor category work as program directors or project advisers, providing project vision, strategic consulting, and program management activities for GIS and IT projects. These staff members apply market/application domain expertise using extensive experience in

GIS and related geospatial technologies to support the successful completion of the program. Consulting activities may include strategic planning, review and oversight of requirements definitions, application and database design, and system integration. Management activities may include defining program requirements and objectives, establishing budgets and schedules, allocating staff and other resources, and managing and overseeing subcontractor activities. Staff members in this labor category work with senior client staff in coordination with Esri senior management to resolve issues and support successful project completion.

GIS Database Specialist/Analyst (DB) **Hourly Rate: $166**

Staff members in this labor category provide database development support in creating cartographic and digital data products. These staff members have expertise that includes the performance of hard copy to digital data conversion tasks, data migration, and translation activities utilizing advanced processing techniques in ArcGIS. These individuals design, develop, and implement efficient production tools and workflows in accordance with approved project plans and design parameters.